an examination by CT the patient is required to remain immobile for several minutes. Restless patients and children may require sedation to minimize movement. With present equipment, 12 to 15 patients can be examined in a ten-hour day, but with anticipated technical improvements, this patient volume may be increased.

The ultimate resolution of the instrument is determined by the physical characteristics; with the 80 by 80 matrix that has been standard until just recently, the computer calculates the results in a three mm square with a thickness that can be varied from 8 to 13 mm, with 13 mm being the accepted standard. The new high resolution option, recently available, has a 160 by 160 matrix so that the computer will be looking at squares half the size of the original. There are other improvements included with the high resolution option which it is hoped will contribute to lessening the rate of error. A modification of the technique of examination which will contribute to a reduction in the error rate is the use of contrast enhancement; this is proving to be especially helpful in certain meningiomas, smaller acoustic neurinomas, metastasis and arterial venous malformation. Other factors which limit resolution are (1) motion and (2) physical factors at the skull base, in the posterior fossa and at the convexity. Lesions which are least likely to be detected by current CT techniques fall into two categories: (1) small lesions involving or adjacent to the hypothalamus, optic chiasm and optic nerve, and in the cerebellopontine angle and (2) primary vascular lesions, whether looking for the source of subarachnoid hemorrhage or occlusive disease (the CT scan may show the infarct but will give no specific information about the condition of the vessel).

The accuracy of this technique in its initial evaluation has been very promising. In the first 500 patients examined at the Mayo Clinic, the error rate was 3.6 percent (of the patients in this series who had other neuroradiological studies done, the corresponding error rates were pneumoencephalography, 2.1 percent; angiography, 6.5 percent, and isotope scans, 35 percent). There are certain lesions which have a characteristic pattern allowing a specific diagnosis. These include epidural and intracerebral hematoma; porencephalic, colloid and epidermoid cysts; cystic craniopharyngioma and cholesteatoma and pineoloma. The CT scan will be of particular value with trauma patients: intracerebral hematomas can be very easily differentiated from contusion, laceration and edema. There are other conditions in which the Mayo group found a high degree of diagnostic correlation (hydrencephalus, 92 percent; metastasis, 69 percent; dementia or degenerative states, 67 percent, suspected mass lesion, 62 percent, and infarction, 48 percent).

GABRIEL H. WILSON, MD

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Endoscopic Pancreaticholangiography (EPCG)

ENDOSCOPIC PANCREATICHOLANGIOGRAPHY (EPCG) provides valuable diagnostic information in patients with diseases of the pancreas and biliary tree. A side-viewing fiberoptic endoscope is visually directed into the duodenum and the papilla of Vater identified and cannulated with a flexible polyethylene tube. Injection of roentgenographic contrast material and fluoroscopic spot filming shows the anatomy of the pancreatic and biliary ducts.

EPCG is indicated in patients with (1) abdominal pain of unknown cause to corroborate a suspicion of pancreatic disease, (2) chronic relapsing pancreatitis for evaluation of possible surgical intervention, (3) suspected pancreatic carcinoma—patients with pancreatograms suspicious of carcinoma may undergo repeat cannulation for aspiration-cytology of pancreatic secretions, (4) obstructive jaundice—unlike transhepatic cholangiography, EPCG does not require immediate laparotomy and (5) postcholecystectomy syndromes.

Hazards of EPCG include those associated with any endoscopic procedure. In up to 45 percent of patients who undergo endoscopic pancreatography, there will be a transient elevation of serum amalyse without evidence of clinical pancreatitis. In approximately one percent of patients in this group, there will be clinically significant mild pancreatitis. EPCG is hazardous in patients with pancreatic pseudocyst because of the increased risk

of infection. These patients may be identified by ultrasound examination. EPCG is contraindicated in acute pancreatitis because an increase in pancreatic duct pressure during injection of contrast material may exacerbate the acute attack. Before jaundiced patients undergo EPCG, negative results of tests for hepatitis-associated antigen should be obtained to avoid the possibility of disseminating hepatitis virus. Patients with jaundice and a history of ascending cholangitis should receive antibiotic coverage before EPCG to avoid sepsis precipitated by retrograde injection beyond a biliary obstruction.

It is difficult to precisely evaluate the accuracy of EPCG at this time. It is certainly extremely accurate in the evaluation of the biliary tree provided that enough contrast material is injected to completely visualize the entire biliary tree. The accuracy of EPCG in pancreatic disease is less well known. Results of a recent study done by David S. Zimmon and associates state that in 34 of 63 patients (54 percent), the initial clinical diagnosis of pancreatitis was changed or more accurately defined, and in 21 of 63 (33 percent), an indication for surgical operation was established by the procedure. The number of patients with pancreatic disease in whom pancreatograms give completely negative findings is not presently known.

The most recent study of complications related to EPCG was done by Bilbao and co-workers. In the study, results of 10,435 EPCGs done by 402 operators in 220 centers across the United States were compiled using questionnaires. A 70 percent overall success rate with a 3 percent incidence of complications was shown. Although transient evaluation of serum amylase was commonly noted after EPCG, the incidence of clinically apparent pancreatitis was about 1 percent. This was usually mild, and was not associated with any fatalities in Bilbao's series. Death related to EPCG occurred in a small number of patients with biliary obstruction, pancreatic duct obstruction or pseudocysts.

In some centers, such patients—those at increased risk of infection—are put on antibiotics before the procedure. Time and well-controlled clinical studies will show whether this will decrease the incidence of fatal infectious complications of EPCG. Some routinely add chloramphenicol (Chloromycetin®) to the Renografin-60® (meglumine diatrizoate [52 percent] and sodium diatrizoate [8 percent]) used for duct injection. Both the success rate and complication rate are related to the experience of the operator. EPCG appears to be the procedure of choice in patients with obstructive jaundice. Patients with chronic relapsing pancreatitis, persistent abdominal pain associated with pancreatitis and complications of pancreatitis such as pseudocysts should have EPCG for accurate staging of their disease and planning possible surgical intervention.

JEROME A. GOLD, MD

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Drainage of Obstructed Kidneys by Percutaneous Nephrostomy

PERCUTANEOUS NEPHROSTOMY is a safe and effective method for relief of obstruction to a kidney. The technique is a modification of antegrade pyelography and makes use of skills and instrumentation from angiography. The obstructed kidney is localized either by ultrasound or by intravenous or retrograde administration of contrast material. Under fluoroscopy an 18 gauge Longdwell needle is inserted into a dilated upper calix, and the Teflon® sheath from the Longdwell needle is left in place in the collecting system. Through the sheath a guide wire is passed into the renal pelvis. The Teflon sheath is then removed and a multiple side hole angiographic catheter is inserted over the guide wire. Location of the catheter is checked radiographically and the catheter is sutured to the skin. Progressively larger catheters are used to obtain an eventual 18 F catheter size for permanent use. The catheter eventually should be soft rubber or sialastic to prevent damage to the kidney. The tube should have as many side holes as possible to allow free drainage. A closed system is constructed by connecting the catheter to a collection bag.

Minor complications have been encountered which for the most part are self-limited. These include (1) bleeding associated with initial needle puncture and guide wire manipulations, (2) perforation of a calix by the guide wire, (3) mucosal